Translation of the pertinent portions of a letter from KBA to the EPO dated August 24, 2005:

IN RESPONSE TO THE NOTICE DATED JULY 27, 2005,
WE ARE SUBMITTING AMENDMENTS IN ACCORDANCE WITH ART. 34 PCT

1. We are submitting the following:

   1.1 Claims
   (Replacement sheets 29, 35, and 36, version of August 24, 2005)

      1.1.1 New Claim 1
      The new Claim 1 is comprised of features from original Claims 1 and 47.

      1.1.2 Claims 39 and 47
      The reference has been adapted for each of Claims 39 and 47.

      1.1.3 The remaining Claims are unchanged.

   1.2 Introduction to the Specification
   (Replacement/additional pages 1 and 1a, version of August 24, 2005)
   D1 has been cited.

2. Regarding the references

   2.1 D1 = EP 0 477 536 A2

   D1 discloses an optical system for producing an illuminated strip on a surface of a material, with an illumination device having multiple light sources being arranged at a distance from the surface of the material, with the illumination device with its light-emitting light sources producing the illuminated strip on the material, which is moving relative to the illumination device, with the illumination device having a mirror that bundles the light emitted by the light sources onto the illuminated strip and to its light exit side facing the surface of the material, with the illumination device having at least one reflector module containing the diffuser and the mirror, with the light sources feeding their light into the reflector module.

3. Novelty and inventive step

   The object of the new Claim1 differs from the optical system known from D1 by virtue of the fact that the light emitted by the light source (07) is bundled more strongly along the length (L01) of the illuminated strip (01) than the light along its width (B01).

The advantage that is attainable with the invention lies in particular in the fact that the reflector module forms the optical path of the light emitted by the light sources to suit current needs, it homogenizes the emitted beams of light, and bundles them in a targeted fashion to form a narrow band of light (specification, page 5, paragraph 3).

The selective controllability of light sources disposed next to one another according to independent Claims 8 and 98 also has the advantage that, in spite of disruptive influences, for example, by transmission losses in the recording device capturing the light, an even, homogenized luminosity profile can be achieved over the length of the illumination device (specification, page 7, paragraph 2 and page 23, last paragraph).

4. Interview

If the Examination Division still has any reservations regarding the clarity and inventive step of the patent application we have submitted, we request an

INTERVIEW

before the issue of the IPER. Please contact us at the telephone number 0931 / 909-61 30 to briefly discuss a date and time.

Enclosures:
Claims, replacement pages 29, 35, and 36
(pages with handwritten corrections have been enclosed),
Specification, replacement/additional pages 1 and 1a,
each in the version of August 24, 2005, enclosed in triplicate.

[Translator's Note: all text in *italics* in the modified sheets is handwritten]

Claims

1. An optical system for producing an illuminated strip (01) on a surface (02) of a material (03), with an illumination device (06) having several light sources (07) arranged at a distance (A07) from the surface (02) of the material (03), with the illumination device (06) with its light sources (07) producing the illuminated strip (01) on the surface (02) of the material (03), which is in motion relative to the illumination device (06), with the illumination device (06) having at least one mirror (11; 16) bundling the light emitted by the light sources (07) onto the illuminated strip (01) and having a diffuser (38) on its light exit side facing the surface (02) of the material (03), ~~characterized in that~~ with the illumination device (06) ~~has~~ having at least one reflector module (39) *including the diffuser (38) and the mirror (11; 16)*, ~~with the light sources (07) feeding their light into the reflector module (39), with the reflector module (39) embodying the diffuser (38) and the mirror (11; 16) in one individual component.~~ *characterized in that <Claim 47>*

2. The optical system in accordance with Claim 1, characterized in that the illumination device (06) comprising several modules (M61 to M65) arranged in a row next to one another, each having several light sources (07) arranged next to one another.

3. The optical system in accordance with Claim 2, characterized in that several of the modules (M61 to M65) that are arranged in a row next to one another have at least one reflector module (39).

4. The optical system in accordance with Claim 1, characterized in that the light sources (07) are divided into groups.

5. The optical system in accordance with Claim 4, characterized in that

38. The optical system in accordance with Claim 1, 11, or 12, characterized in that the reflector module (39) forms and homogenizes the light emitted by the light sources (07) with regard to the illuminated strip (01).

39. The optical system in accordance with Claim ~~1 or~~ 8, characterized in that the illumination device (06) forms the illuminated strip (01) with a width (B01) extending orthogonally to its length (L01) on the surface (02) of the material (03).

40. The optical system in accordance with Claim 1 or 8, characterized in that the illuminated strip (01) is disposed outside of a focal point of the light emitted by the light sources (07) located in the optical path.

41. The optical system in accordance with Claim 1 or 9, characterized in that the mirror (11) has at least one active surface (12) directed along the length (L01) and/or the width (B01) of the illuminated strip (01).

42. The optical system in accordance with Claim 41, characterized in that the mirror (11) with its active surface (12) constricts the light emitted by at least one of the light sources (07) of the illumination device (06) in a solid angle (ω) into a smaller first enveloping surface (AH1) than the spherical surface (AK) pertaining to the solid angle (ω).

43. The optical system in accordance with Claim 1 or 9, characterized in that another mirror (16) having at least one active surface (17) is arranged in a central area (14) surrounding the optical path of the central beam (13) within the solid angle (ω) of the light emitted by at least one of the light sources (07) of the illumination device (06).

44. The optical system in accordance with Claim 43, characterized in that the active surface (17) of the other mirror (16) first diverts the light emitted by at least one of the light sources (07) of the illumination device (06) against at least one active surface (12) of the first mirror (11) that is directed along the length (L01) or the width (B01) of the illuminated strip (01) and then the active surface (12) of the first mirror (11) diverts it to the illuminated strip (01).

45. The optical system in accordance with Claim 1 or 8, characterized in that at least one lens (18) is arranged in a central area (14) surrounding the optical path of the central beam (13) within the solid angle (ω) of the light emitted by at least one of the light sources (07) of the illumination device (06).

46. The optical system in accordance with Claim 45, characterized in that the lens (18) bundles at least part of the light emitted by at least one of the light sources (07) in the solid angle (ω) that was not deflected onto the illuminated strip (01) by the active surface (12) of the first mirror (11).

47. The optical system in accordance with Claim ~~1 or~~ 8, characterized in that the light emitted by the light source (07) is bundled more strongly along the length (L01) of the illuminated strip (01) than the light along its width (B01).

48. The optical system in accordance with Claim 1, 9, or 45, characterized in that the arrangement of the mirrors (11; 16) and/or the lens are embodied as being integrated into the reflector module (39).

49. The optical system in accordance with Claim 42, characterized in that the solid angle (ω) spans a surface (AK) cut from a sphere, up to the size

Replacement Page

Description

Optical Systems for Producing an Illuminated Strip

The invention relates to optical systems for producing an illuminated strip in accordance with the generic portion of Claim 1, 9, or 98.

Their application lies primarily in the imaging of machine-processed material for industrial image processing, for example, of printing materials processed in security printing, with the optical system being used in or on a printing press, preferably in or on a rotation printing press, in particular in or on a printing press printing in an offset printing method, in a steel engraving method, in a serigraphy method, or in a hot embossing method. As an alternative or in addition to an arrangement in or on a printing press, the optical system may also be arranged in or on a machine that continues to process the printed product. The image acquisition occurs with the purpose of an at least partial, preferably complete, imaging of the moving material, with our without measurement of previously established properties of this material so as to evaluate this material with regard to the quality of a processing step previously performed in the machine. Generic optical systems are used, for example, in an in-line inspection system and thus form a component of an in-line inspection system.

EP 0 477 536 A2 discloses an optical system for producing an illuminated strip on a surface of a material, with an illumination device having multiple light sources being arranged at a distance from the surface of the material, with the illumination device with its light-emitting light sources producing the illuminated strip on the material, which is moving relative to the illumination device, with the illumination device having

a mirror that bundles the light emitted by the light sources onto the illuminated strip and to its light exit side facing the surface of the material, with the illumination device having at least one reflector module containing the diffuser and the mirror, with the light sources feeding their light into the reflector module.

An image reading device is known from DE 35 27 300 C2 in which an illumination device with several groups of light sources is provided, with the groups of light sources emitting light for the purpose of producing an illuminated strip, with a control device operating the groups of light sources in a pulsed fashion, with photosensors arranged in rows capturing the light reflected by the surface of the material, with the photosensors forming a line camera,

Claims

1. An optical system for producing an illuminated strip (01) on a surface (02) of a material (03), with an illumination device (06) having several light sources (07) arranged at a distance (A07) from the surface (02) of the material (03), with the illumination device (06) with its light-emitting light sources (07) producing the illuminated strip (01) on the surface (02) of the material (03), which is in motion relative to the illumination device (06), with the illumination device (06) having at least one mirror (11; 16) bundling the light emitted by the light sources (07) onto the illuminated strip (01) and having a diffuser (38) on its light exit side facing the surface (02) of the material (03), with the illumination device (06) having at least one reflector module (39) including the diffuser (38) and the mirror (11; 16), with the light sources (07) feeding their light into the reflector module (39), characterized in that the light emitted by the light source (07) is more strongly bundled along the length (L01) of the illuminated strip (01) than the light along its width (B01).

2. The optical system in accordance with Claim 1, characterized in that the illumination device (06) comprising several modules (M61 to M65) arranged in a row next to one another, each having several light sources (07) arranged next to one another.

3. The optical system in accordance with Claim 2, characterized in that several of the modules (M61 to M65) that are arranged in a row next to one another have at least one reflector module (39).

4. The optical system in accordance with Claim 1, characterized in that the light sources (07) are divided into groups.

5. The optical system in accordance with Claim 4, characterized in that

38. The optical system in accordance with Claim 1, 11, or 12, characterized in that the reflector module (39) forms and homogenizes the light emitted by the light sources (07) with regard to the illuminated strip (01).

39. The optical system in accordance with Claim 8, characterized in that the illumination device (06) forms the illuminated strip (01) with a width (B01) extending orthogonally to its length (L01) on the surface (02) of the material (03).

40. The optical system in accordance with Claim 1 or 8, characterized in that the illuminated strip (01) is disposed outside of a focal point of the light emitted by the light sources (07) located in the optical path.

41. The optical system in accordance with Claim 1 or 9, characterized in that the mirror (11) has at least one active surface (12) directed along the length (L01) and/or the width (B01) of the illuminated strip (01).

42. The optical system in accordance with Claim 41, characterized in that the mirror (11) with its active surface (12) constricts the light emitted by at least one of the light sources (07) of the illumination device (06) in a solid angle (ω) into a smaller first enveloping surface (AH1) than the spherical surface (AK) pertaining to the solid angle (ω).

43. The optical system in accordance with Claim 1 or 9, characterized in that another mirror (16) having at least one active surface (17) is arranged in a central area (14) surrounding the optical path of the central beam (13) within the solid angle (ω) of the light emitted by at least one of the light sources (07) of the illumination device (06).

44. The optical system in accordance with Claim 43, characterized in that the active surface (17) of the other mirror (16) first diverts the light emitted by at least one of the light sources (07) of the illumination device (06) against at least one active surface (12) of the first mirror (11) that is directed along the length (L01) or the width (B01) of the illuminated strip (01) and then the active surface (12) of the first mirror (11) diverts it to the illuminated strip (01).

45. The optical system in accordance with Claim 1 or 8, characterized in that at least one lens (18) is arranged in a central area (14) surrounding the optical path of the central beam (13) within the solid angle (ω) of the light emitted by at least one of the light sources (07) of the illumination device (06).

46. The optical system in accordance with Claim 45, characterized in that the lens (18) bundles at least part of the light emitted by at least one of the light sources (07) in the solid angle (ω) that was not deflected onto the illuminated strip (01) by the active surface (12) of the first mirror (11).

47. The optical system in accordance with Claim 8, characterized in that the light emitted by the light source (07) is bundled more strongly along the length (L01) of the illuminated strip (01) than the light along its width (B01).

48. The optical system in accordance with Claim 1, 9, or 45, characterized in that the arrangement of the mirrors (11; 16) and/or the lens are embodied as being integrated into the reflector module (39).

49. The optical system in accordance with Claim 42, characterized in that the solid angle (ω) spans a surface (AK) cut from a sphere, up to the size